REMARKS

Claims 1-10, 12-48 and 50-51 are pending in the present application. By this amendment, Claims 1, 22, 34 and 43 are amended. Support for the amendments can be found throughout the specification, e.g. at page 1, lines 24-26; page 10, lines 2-10; page 11, lines 16-18; page 13, lines 17-19; page 14, lines 3-4; and the original claims. Applicants respectfully request consideration of the present claims in view of the foregoing amendments and the following remarks.

I. Formal Matters:

Response To Claim or Rejections Under 35 U.S.C. § 112

Claims 1-10, 12-48 and 50-51 stand rejected under 35 U.S.C. § 112, for allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Examiner states that the claims set forth a ratio of organic solvent to water but fail to define the units of said ratio. Applicants respectfully disagree with this rejection. A ratio by definition does not contain a unit. However, Applicants have amended the claims to specify that the ratio is a volume ratio.

Claims 13-14 and 31-32 stand rejected under 35 U.S.C. § 112 as allegedly being indefinite because these claims recite "about 90°C" whereas the independent claim recites "less than 90°C." Applicants have amended the independent claims to recite "less than about 90°C." As such, Applicants respectfully submit that the claims are now properly dependent and request withdrawal of these rejections.

II. Prior Art Rejections:

Claims 43-48 and 50-51 stand rejected under 35 U.S.C. § 102 (b) as being anticipated by Y.T. Moon et al., "Preparation of Monodispersed and Spherical Zirconia Powders by Heating of Alcohol-Aqueous Salt Solutions", J. Am. Ceram. Soc., 78(10): 2690-2694 (1995) (hereinafter "Moon"). This rejection is respectfully traversed.

Claim 43 is directed, *inter alia*, to a method of producing monodispersed particles at room temperature, comprising preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water; incubating the solution at room temperature for a period of time; wherein the metal salt concentration, volume ratio of organic solvent to water,

and time are selected to provide a sol having desired characteristics; wherein the sol is capable of forming a coating; wherein drying the sol to produce a powder of monodisperse particles; and wherein the volume ratio of organic solvent to water ranges from about 1 1 to about 10 1.

The Examiner alleges that the above-referenced article discloses methods of making monodispersed ZrO_2 particles from zirconyl chloride solutions.

It is respectfully submitted that Moon fails to teach or suggest Applicants' claimed invention. Moon's article is clearly different from Applicants' invention as claimed since Moon discloses producing a monodispersed, spherical zirconia **powder** via microwave heating. (See Table 1). Moon's article discloses that in order to produce non-agglomerated spherical particles microwave heating **must be utilized**. (See Figures 1-4). Further, Moon **does not teach or suggest sol-gel processing** in inorganic metal salt solutions which are useful as precursors in various technologies, such as the coating industry. Moon does not address the particle connectivity that is present in a porous gel network, particle morphology or particle hardness as does the sol-gel processing of the claimed invention. See Examples.

In contrast Applicants' claimed invention is not limited to powder formation, rather Applicant's invention is directed to **producing a sol or a gel** containing dispersed particles which are useful in coatings and films. The **claimed method is unique** in sol-gel coating applications with inorganic metal salt precursors. See Example 10 illustrating the capability of the methods of achieving sol and gel processing in inorganic metal salt solutions of mixed alcohol-water solvent. Applicants' claimed invention also utilizes different solvents than are disclosed in Moon. The product produced from the claimed product can be a sol or a gel and therefore is more polymeric than the powder produced by Moon. Further, Applicants claimed invention does not utilize microwave heating at high temperatures.

Accordingly, as Applicants' specifically claim that the materials formed are capable of being used in coating applications, and as the powders of Moon could not form a coating since they would not adhere to the material being coated, Applicants respectfully submit that Moon fails to teach or suggest Applicants' claimed invention. Moon simply never discusses the formation of sols or gels anywhere in the article and therefore cannot be said to teach these materials or any of their applications, such as coatings.

For at least the reasons given above, Applicants respectfully submit that Claim 43 is allowable over the art of record. Furthermore, since Claims 44-48 and 50-51

recite additional claim features and depend from Claim 43, these claims are also allowable over the art of record. Accordingly, Applicants respectfully request withdrawal of this rejection.

Claims 1-3, 7-10, 12-18, 22-23, 25-29, 31-35, 37-40, 42-44 and 46-48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the article by M.Z.C. Hu et al., "Nucleation and Growth for Synthesis of Nanometric Zirconia Particles by Forced Hydrolysis", J. of Colloid and Interface Science, 198:87-99 (1998) (hereinafter "Hu"). This rejection is respectfully traversed.

Applicants claimed invention set forth in Claims 1, 22, 34 and 43 are set forth above.

The Examiner alleges that Hu discloses methods of making nanoparticles by mixed solvent nucleation and growth of zirconia particles.

It is respectfully submitted that Hu fails to teach or suggest Applicants' claimed invention. Hu is directed to the formation of particles, not sols or gels. As Hu never discusses the formation of sols or gels anywhere in the article, Hu cannot be said to teach these materials or any of their applications, such as coatings. Since Applicants invention, as now claimed, requires that the sols and/or gels be capable of being used in coating applications, and as sols and/or gels are never disclosed in Hu, Applicants respectfully submit that Hu fails to teach or suggest Applicants' claimed invention.

Additionally, Hu's article is clearly different form Applicants' invention as claimed since Hu discloses forming nanosized, **cube-shaped** monoclinic zirconia particles via thermal incubation at **elevated temperatures** (95 to 120°C) which induces **forced hydrolysis** and condensation of zirconium tertramer. The forced hydrolysis process disclosed by Hu is **slow** in producing particles. Further, the forced hydrolysis process takes a few days for the complete conversion from soluble zirconium species to solid nanoparticles (See Table 1). Further, Hu discloses using 0.4:1 to 1:1 ratio of isopropanol to water.

In contrast, Applicants' invention as claimed is not directed to forming cube-shaped nanosized zirconia particles at elevated temperatures via forced hydrolysis. Rather Applicants' claimed invention discloses producing **sphere particle shapes** by utilizing **lower temperatures** and higher organic solvent to water ratios. Hu utilizes higher temperatures to control particle growth. Compare Figures 5 and 6 in Hu which illustrate that at room temperature the particle size grew to over 500 nm within 5 minutes however at higher temperatures the particles remained under 300 nm over 25 hours.

Comparatively Applicant's claimed invention utilizes lower temperatures and higher organic solvent to water ratios while still being able to control particle growth. The process of Applicants' invention causes **homogenous precipitation** due to the creation of supersaturation in low dielectric medium **rather than forced hydrolysis** as disclosed in Hu. The sol-gel process refers to homogenous nucleation and growth of a polymer in a liquid medium which forms a uniform powder or gel after drying. The claimed method is unique in sol-gel coating applications with inorganic metal salt precursors. Further, the incubation time of the Applicant's invention is much shorter than the incubation time disclosed in Hu. (See Table 1, Page 7).

For at least the reasons given above, Applicants respectfully submit that Claims 1, 22, 34 and 43 are allowable over the art of record. Furthermore, since Claims 2-3, 7-10, 12-18, 23, 25-29, 31-33, 35, 37-40, 42, 44 and 46-48 recite additional claim features and depend from either Claim 1, Claim 22, Claim 34 or Claim 43, these claims are also allowable over the art of record. Accordingly, Applicants respectfully request withdrawal of this rejection.

III. Conclusion:

For at least the reasons given above, Applicants submit that Claims 1-10, 12-48 and 50-51 define patentable subject matter. Accordingly, Applicants respectfully request allowance of these claims.

Should the Examiner believe that anything further is necessary in order to place the application in better condition for allowance, the Examiner is respectfully requested to contact Applicants' representative at the telephone number listed below.

No additional fees are believed due; however, the Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, to Deposit Account No. 11-0855.

Respectfully submitted,

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AMENDMENTS IN THE APPLICATION:

In accordance with 37 C.F.R. 1.121(c), the following changes to the claims as rewritten by the foregoing amendment show all of the changes made relative to the previous versions of the claims.

In the Claims:

1. (Amended) A method of sol-gel processing using an inorganic metal salt and a mixed solvent system, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at a temperature less than about 90° C for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time are selected to provide a sol or a gel having desired characteristics;

wherein the sol or the gel is capable of forming a coating;

wherein the volume ratio of organic solvent to water ranges from about 1:1 to 10:1; and

wherein nanosized particles are produced.

12. (Amended) The method of claim 1, wherein the volume ratio of organic solvent to water ranges from about 1:1 to about 5:1.

17. (Amended) The method of claim 1, wherein the volume ratio of organic solvent to water ranges from about 1:1 to about 2:1 and a gel is produced.

22. (Amended) A method of producing nanosize particles using an inorganic metal salt and a mixed solvent system, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the mixture at a temperature less than about 90°C for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time have been manipulated to provide primary particles in the solution having a diameter of about 10 nm to about 100 nm;

wherein the primary particles are capable of forming a sol-gel coating; and

wherein the volume ratio of organic solvent to water ranges from about 1:1 to 10:1.

29. (Amended) The method of claim 22, wherein the volume ratio of organic solvent to water ranges from about 1:1 to about 10:1.

30. (Amended) The method of claim 29, wherein the volume ratio of organic solvent to water ranges from about 2:1 to about 10:1.

34. (Amended) A method of producing a sol from an inorganic metal salt at room temperature comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at room temperature for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, and time are selected to provide a sol having desired characteristics;

wherein the sol is capable of forming a coating;

wherein the volume ratio of organic solvent to water ranges from about 1:1 to about 10:1; and

wherein the sol contains nanosized particles.

40. (Amended) The method of claim 34, wherein the volume ratio of organic solvent to water ranges from about 1:1 to about 10:1.

43. (Amended) A method of producing monodispersed particles at room temperature, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at room temperature for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, and time are selected to provide a sol having desired characteristics;

wherein the sol is capable of forming a coating;

wherein drying the sol to produce a powder of monodisperse particles; and

wherein the volume ratio of organic solvent to water ranges from about 1:1 to about 10:1.

50. (Amended) The method of claim 43, wherein the volume ratio of organic solvent to water ranges from about 5:1 to about 10:1.